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PCT

I, JULIE BILLINGSLEY, TEAM LEADER EXAMINATION SUPPORT AND
SALES hereby certify that annexed is a true copy of the Provisional specification
in connection with Application No. 2003904338 for a patent by PROTEGY
LIMITED as filed on 15 August 2003.



WITNESS my hand this
Twenty-third day of August 2004

J. Billingsley

JULIE BILLINGSLEY
TEAM LEADER EXAMINATION
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15.8.03

Provisional Patent Application in the name of Protegy Limited

Title; Conversion of steam to hydrogen using non-linear dynamics to manipulate molecular oscillations and semi conductor currents.

Patent No PCT AU00/00646, 12.5.99, priority date, describes the reduction of water using a combination of redox reactions, each of which is enhanced by the presence of the other. The electrochemical interactions take place on a perforated reaction platform.

The aim of the apparatus described in PCT AU00/00446 is to produce hydrogen and heat at a vigorous rate. This was in part achieved by a suitable selection of $\frac{1}{2}$ cell reactions and chemical concentrations, producing approximately 67 litres of hydrogen from one litre of water.

To extend our system and increase our hydrogen production from 76.2 L to 515.21 per 54 grams of basic metal it is our intent to convert the steam produced in the first cell to hydrogen through a second cell using non-linear dynamics to manipulate molecular oscillations and semi conductor currents. We call this extended system our:

ENHANCEMENT PROCESS

The Alternative Energy reactor produces a gaseous mix of 13% hydrogen and 87% steam (by volume). The steam can either be;

- *Condensed within the reactor using rashik rings or a helical water circulation system for external hot water delivery, or
- * separated from the hydrogen using a porous refractory membrane and then reformed into hydrogen by either of the following mechanisms.

- A. BOSCH INDUSTRIAL PROCESS (Reference A)
 - B. Low temperature auto thermal steam/methane reforming system using a fluidised bed membrane reactor. (Reference B)
 - C. Use of activated iron to reduce steam to hydrogen. (Reference C,D,E.)
 - D. Steam dissociation on a zirconia surface at high temperatures (Reference F)
- These processes are essentially endothermic and heat is required to maintain the reactor temperatures. In the case of activated iron (Process C) the reaction temperature of 100 degrees centigrade satisfies the operating parameters of the Alternative Energy reactor but the regeneration of the iron from the oxide adds to the cost of the hydrogen.

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The most promising of the above approaches appears to be Process B, which is being developed by our colleagues in America.

Over 30 years ago research workers (Reference G) described the sunlight assisted electrolysis of water using ceramic photo electrodes. A great deal of progress has been made in this field including the use of a composite semi conductors and heterogeneous photocatalysis in a non-galvanic cell situation to dissociate water into hydrogen and oxygen.

In 1996, studies in the United Kingdom (Reference H) revealed that "in the early stages the (water) molecule was drawn down to the surface rapidly and its favourable orientation was in the (001) plane with the oxygen atom pointing towards the surface. When the oxygen atom is within 2.7 Angstrom of bridging oxide iron there is a strong interaction between the hydrogen and the bridging oxygen. This hydrogen atom is captured by the bridging oxygen and the hydroxyl remnant of the water molecule adsorbs above the fivefold "cation site".

Our enhancement process aims at enhancing the number of dissociated water molecules adsorbed on the photo electrode and then releasing the terminal OH groups as oxygen gas and the bridging OH groups as hydrogen gas. The terminal OH groups therefore act as electron donors.

E_o

Viz OH (-) gives you $\frac{1}{2}O_2 + H (+) + 2e - 1.23V$.

Whereas the bridging protonated oxide ions act as electron acceptors.

E_o

Viz $2e + OH(-) + H(+)$ gives you $0 = + H_2 - 0.00V$.

The discharge of the terminal OH group will produce oxygen gas plus a proton. This proton is attracted towards a negative OH bridging group where reduction produces hydrogen gas and an oxide ion, which remains in the crystal lattice.

Non-linear dynamics will be used to manipulate molecular oscillations and semi conductor currents increasing our production from 67.2L to 515.2 L of hydrogen per 54 grams of basic metal..

Alan Mitchell
Protégé Limited

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OK